Driver Perception of Fluorescent Yellow Green Signage

Busisiwe Marole[1], Keolebogile Bosilong[2], Tshegofatso Mongae[3], Namatirai Cheure[4], Karien Venter[5]

[1]*Smart Mobility, CSIR, PO Box 395, Pretoria, 0001, bmarole@csir.co.za*
[2]*Smart Mobility, CSIR, PO Box 395, Pretoria, 0001, kbosilong@csir.co.za*
[4]*Smart Mobility, CSIR, PO Box 395, Pretoria, 0001, tmongae@csir.co.za*
[5]*Smart Mobility, CSIR, PO Box 395, Pretoria, 0001, ncheure@csir.co.za*
[6]*Smart Mobility, CSIR, PO Box 395, Pretoria, 0001, kventer@csir.co.za*

Extended Abstract

1. Introduction

The Safe System Approach (SSA), to which South Africa is a signatory, is the premise of the South African National Road Safety Strategy (SANRSS) that aims to significantly reduce the number of road traffic fatalities and severe injuries. It recognizes that human error is inevitable and seeks to minimize the consequences of mistakes by designing roads, environments, vehicles, and traffic systems that are more forgiving. Road signs play a critical role in ensuring the safety of both motorists and pedestrians on roadways. International evidence points to the fact that among the various colours used for road signage, "fluorescent yellow green (FY/G)" or "safety yellow," stands out as a colour that commands attention. FY/G signs has emerged as an effective and attention-grabbing colour to highlight hazardous locations and conditions. FY/G is vibrant and highly visible appearance, especially in adverse weather conditions and low-light situations. However, it is currently not part of the South African Road Traffic Signs Manual (SARTSM), which is the guiding regulation for the application of road signs in South Africa. A pilot study was undertaken for South Africa, to measure the perception of FY/G for South African drivers. This extended abstract provides feedback regarding the preliminary findings in support of the use of FYS signage as part of the South African road environment.

2. Material and Methods

A pilot study was conducted to test impact of the FY/G signage on South African driver perception and driver behaviour. A mixed method approach (that includes both qualitative and quantitative research methodologies) was preferred to carry out the research. The methodology followed included a literature review which was conducted to gather sufficient information about the FY/G signs and their application, internationally and locally. Stakeholder engagements with industry and road authorities assisted with a better understanding of limitations and benefits of using the FY/G signs in a South African context. Experts from industry assisted the research team to place the FY/G signs on the selected study area, a 3 km ring road within the Council for Scientific and Industrial Research (CSIR) campus. An application was developed to map and capture descriptive information of both the standard (as per SARTSM) signage and the newly placed FY/G signage. Lastly, participants were identified, who completed an electronic survey questionnaire before the drive to gather demographic information, driving experience and general perception of road signage. The post-drive electronic survey gathered information about participants experience and perception of the road signage throughout the driving route. Each participant drove the study area route twice. The posted speed limit on the route is 40km/hr. The first drive consisted of the standard signage only (FY/G were covered) and second drive consisted of both the standard signage and the FY/G signage. To measure the driver gaze and perception, each driver wore the Tobii Eye-tracker glasses© for the duration of the drive. The outward facing cameras capture the FY/G signage and non-FY/G along the driving route. The route that the participants drove had the same start and finish points, and both drives were in the same direction.

3. Results and Discussion

The literature findings confirmed that FY/G signs are quite effective and readable even in unfavorable lighting conditions such as bad weather and night-time (Schnell, T., et al., 2001). Tobii Pro Eye Tracker Glasses © used for the study have an accuracy level of about 0.5 degrees of visual angle as reported by Tobii. However, a study by Onkhar et al. found worse accuracy levels, likely due to differing testing conditions. The trial version of the MAXQDA was tested and used to perform the video data analysis. MAXQDA is a software program used for qualitative and mixed methods data analysis, helping researchers organize, code, and analyze textual, visual, and audio data (MAXQDA, 2024).

Before questionnaire survey results

[1] * Corresponding author. Tel.: +000-000-000-0000;
E-mail address: author@institute.xxx

The pilot study consisted of ten participants, five males and five females. Four participants were between 18-30 years, three participants fell into the age group 31-40 years, and another three were between 41-50 years. Five participants have had their driver's license for less than three years, whilst the other five have had their drivers' license for more than three years and up to ranges between 15 – 20 years. Two out of ten participants use prescription glasses when driving. Four out of the ten participants have been involved in a crash wherein three out of the four crashes were due to driver behavior. Seven out of the ten participants indicated that the standard road signs that they usually recognize are stop signs, speed limits, pedestrian signs and guide signs more than any other signs. However, seven out of the ten participants admitted to being aware of the FY/G signs utilized in other countries.

Video data results

The results in Table 1 show that there were relatively higher percentages of glances than fixations at both standard and FY/G signs, by the drivers. Females had higher percentages of glances in relation to standard signs than males. However, males had a higher percentage of glances toward FY/G signs than females. The highest percentage of FY/G signs glanced at was 83%, by two males. One driver in the age group 18 – 30 years and 5 – 10 years of owning a drivers' licence, the other male aged between 31 – 40 years and less than 3 years of owning a drivers' licence. The average glance duration for the standard signage was the same as that for the FY/G signs (0.3 seconds) for the whole population, but the average glance period for the FY/G signs was higher for females (0.4 seconds) compared to males (0.2 seconds). The average fixation duration for the FY/G signs was higher compared to that of standard signs for all drivers, 0.3 seconds vs 0.21 seconds. Women had higher average fixation duration for both standard and FY/ signs (2.3 seconds and 3.7 seconds respectively) compared to men (1.8 seconds and 1.5 seconds respectively). Experienced drivers, who have had their drivers' licence for more than five years have higher average glance and fixation periods compared to the less experienced drivers. One of the factors that may have significantly impacted the accuracy of the results is the level of familiarity of the study area as opposed to the driving experience, age, gender, etc.

Table 1: Video data results

Dermographic information			**Standard road signage**				**FY/G road signage**			
Gender	**Age**	**Drivers' Licence duration (yrs)**	**% of signs glanced**	**Glance Duration (mm: ss.0)**	**% of signs fixated**	**Fixation Duration (mm: ss.0)**	**% of signs glanced**	**Glance Duration (mm: ss.0)**	**% of signs fixated**	**Fixation Duration (mm: ss.0)**
Female	18 - 30	3 < 5	77%	00:00.3	38%	00:01.2	0%	00:00.0	0%	00:00.0
	18 - 30	5 < 10	30%	00:00.5	40%	00:02.2	36%	00:00.7	45%	00:04.2
	31 - 40	10 < 15	89%	00:00.2	0%	00:00.0	75%	00:00.4	0%	00:00.0
	41 - 50	15 < 20	25%	00:00.4	38%	00:03.5	0%	00:00.0	75%	00:03.2
	41 - 50	20 <	60%	00:00.1	0%	00:00.0	67%	00:00.2	0%	00:00.0
Male	18 - 30	< 3	18%	00:00.1	0%	00:00.0	8%	00:00.1	0%	00:00.0
	18 - 30	5 < 10	56%	00:00.1	0%	00:00.0	83%	00:00.4	8%	00:01.5
	31 - 40	<3	20%	00:00.2	0%	00:00.0	83%	00:00.3	0%	00:00.0
	31 - 40	<3	75%	00:00.4	63%	00:01.7	0%	00:00.0	0%	00:00.0
	41 - 50	20 <	33%	00:00.5	11%	00:01.9	83%	00:00.3	0%	00:00.0

***Note: Glance** = 1 second and less, **Fixation**: more than one second.*

Post-drive questionnaire survey results

The participants were required to complete a second survey questionnaire after the second drive where both the standard and FY/G signs were visible. Eight out of ten drivers noticed the FY/G signs, one driver reported that they did not see any FY/G signs and another participant was unsure. Between a scale of 1 – 5, 1 being least visible and 5 being most visible, seven participants rated 4 and five participants rated 5. Five participants indicated that the FY/G signs were easier to see and understand.

4. Conclusion

This pilot research study was conducted in support of a motivation to conduct a large-scale naturalistic driving study. The findings warrant a full research study to be performed on a larger scale with advanced software installation to capture data with better accuracy and precision. The local and national governments can utilize this type of data to make informed decisions related to the implementation of standards that permit FY/G to be utilized in critical routes that are prone to road safety concerns, especially due to visibility issues and in areas where vulnerable road users are prominent. Involvement of the road authorities and promotion of public awareness is also of great importance. The main aim being to improve driver perception of road signage and driver behaviour.

Acknowledgements

- **Tebogo Matsaung, Philip Mashaba, Boniswa Mashaba, Rika Botha, Thendo Malima** and **Mbhoni Mathonsi** contributed to the data collection and analysis.

Keywords: Driver Perception, Road Signage, Fluorescent-Yellow-Green signs, Naturalistic Driving

References

1. Tarko, A., L.N. Boyle, and A. Montella, Emerging research methods and their application to road safety. Accident Analysis & Prevention, 2013. 61: p. 1-2.
2. Rudin-Brown, C. and S. Jamson, Behavioural adaptation and road safety: Theory, evidence and action. 2013: CRC Press.
3. Onkhar, V., Dodou, D. and De Winter, J.C.F., 2023. Evaluating the Tobii Pro Glasses 2 and 3 in static and dynamic conditions. Behavior Research Methods, pp.1-18.
4. Schnell, T., Bentley, K., Hayes, E. and Rick, M., 2001. Legibility distances of fluorescent traffic signs and their normal color counterparts. Transportation research record, 1754(1), pp.31-41.
5. MAXQDA, 2024. MAXQDA – The Art of Data Analysis. Retrieved from https://www.maxqda.com/